Turn In Your Take Home LCQ
as class starts, or before.

Have you seen the movie
"Back To the Future?"

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| | |
|---|---|
| TODAY | • SECTION 2.2 day 2 |
| MON | • SECTION 2.2 day 3 |
| TUES | • Review/FRAPPY! |
| Wed | • TEST ON ch. 2 |

Pick Up the Warm Up
do 1 to 5, then stop

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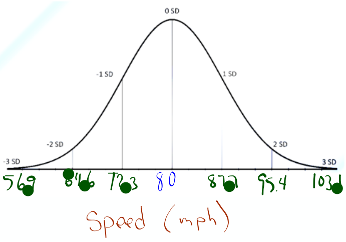
After accelerating for 20 seconds, a DeLorean sports car has a wide range of speeds that it can achieve, depending on traction. The distribution of speed follows an approximately Normal distribution with a mean of 80 mph and a standard deviation of 7.7 mph.

1. Label the appropriate values on the normal distribution



2. What percentage of the runs will give the Delorean a speed greater than 87.7 mph?

+1σ

$50\% - 34\% = \boxed{16\%}$

or. $100\% - 68\% = 32 \rightarrow \frac{32}{2} = 16\%$

3. What percentage of the runs will give the Delorean a speed between 64.6 mph and 87.7 mph?

-2σ +1σ

$13.5 + 68 = \boxed{81.5\%}$

4. What percentage of the runs will give the Delorean a speed less than 64.6 mph?

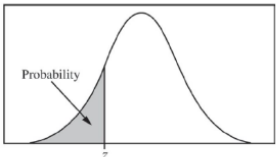
$100 - 95 = 5 \quad \frac{5}{2} = \boxed{2.5\%}$

5. What percentage of the runs will give the Delorean a speed less than 68.45 mph?

68-95-99.7
Emperical Rule
doesn't work

We need TABLE A
from Your Appendix

**Tables for AP Statistics**

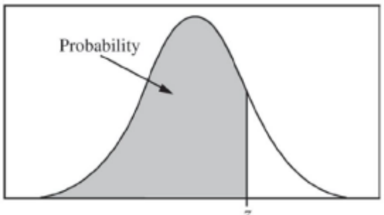


– z-scores

Table entry for $z$ is the probability lying below $z$.

**Table A** **Standard Normal Probabilities**

OR



+ z-scores

Need z-score $\frac{\text{Value} - \text{mean}}{\text{SD}}$

$$= \frac{68.45 - 80}{7.7} = -1.5$$

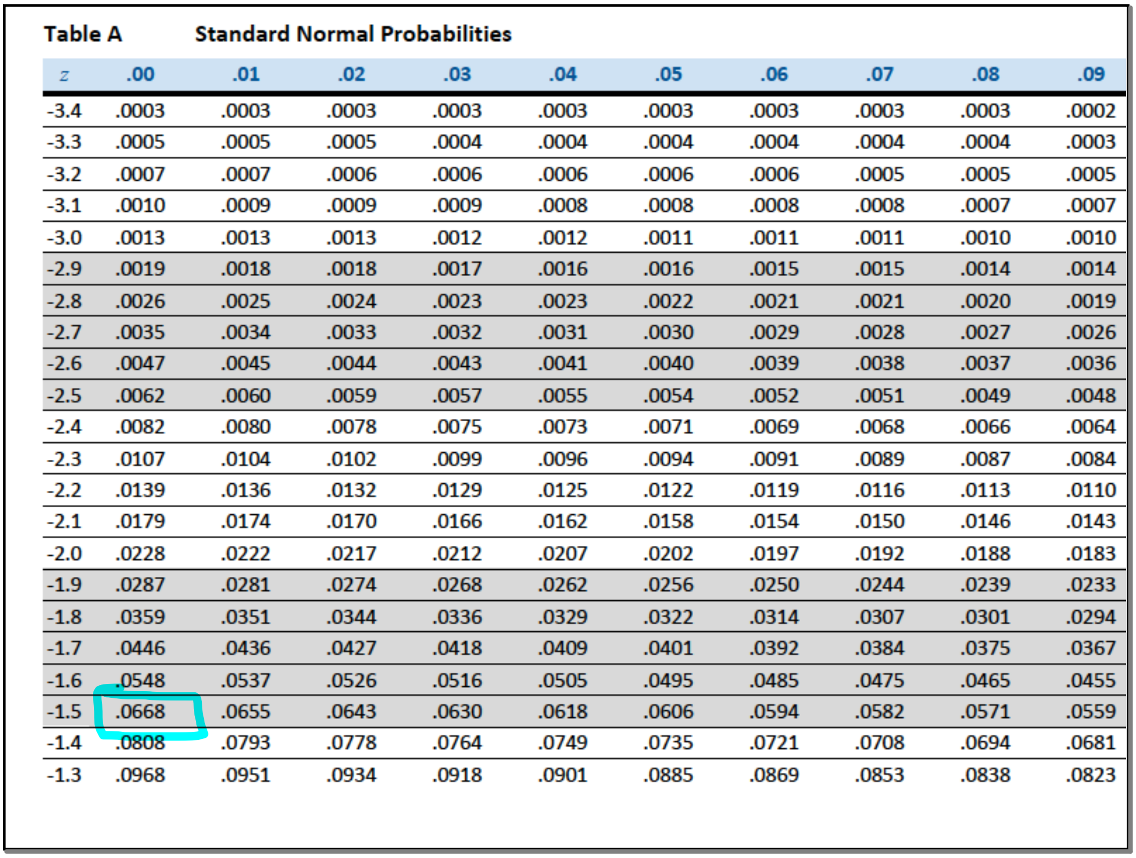


**Table A** **Standard Normal Probabilities**

| *z* | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 |
|---|---|---|---|---|---|---|---|---|---|---|
| -3.4 | .0003 | .0003 | .0003 | .0003 | .0003 | .0003 | .0003 | .0003 | .0003 | .0002 |
| -3.3 | .0005 | .0005 | .0005 | .0004 | .0004 | .0004 | .0004 | .0004 | .0004 | .0003 |
| -3.2 | .0007 | .0007 | .0006 | .0006 | .0006 | .0006 | .0006 | .0005 | .0005 | .0005 |
| -3.1 | .0010 | .0009 | .0009 | .0009 | .0008 | .0008 | .0008 | .0008 | .0007 | .0007 |
| -3.0 | .0013 | .0013 | .0013 | .0012 | .0012 | .0011 | .0011 | .0011 | .0010 | .0010 |
| -2.9 | .0019 | .0018 | .0018 | .0017 | .0016 | .0016 | .0015 | .0015 | .0014 | .0014 |
| -2.8 | .0026 | .0025 | .0024 | .0023 | .0023 | .0022 | .0021 | .0021 | .0020 | .0019 |
| -2.7 | .0035 | .0034 | .0033 | .0032 | .0031 | .0030 | .0029 | .0028 | .0027 | .0026 |
| -2.6 | .0047 | .0045 | .0044 | .0043 | .0041 | .0040 | .0039 | .0038 | .0037 | .0036 |
| -2.5 | .0062 | .0060 | .0059 | .0057 | .0055 | .0054 | .0052 | .0051 | .0049 | .0048 |
| -2.4 | .0082 | .0080 | .0078 | .0075 | .0073 | .0071 | .0069 | .0068 | .0066 | .0064 |
| -2.3 | .0107 | .0104 | .0102 | .0099 | .0096 | .0094 | .0091 | .0089 | .0087 | .0084 |
| -2.2 | .0139 | .0136 | .0132 | .0129 | .0125 | .0122 | .0119 | .0116 | .0113 | .0110 |
| -2.1 | .0179 | .0174 | .0170 | .0166 | .0162 | .0158 | .0154 | .0150 | .0146 | .0143 |
| -2.0 | .0228 | .0222 | .0217 | .0212 | .0207 | .0202 | .0197 | .0192 | .0188 | .0183 |
| -1.9 | .0287 | .0281 | .0274 | .0268 | .0262 | .0256 | .0250 | .0244 | .0239 | .0233 |
| -1.8 | .0359 | .0351 | .0344 | .0336 | .0329 | .0322 | .0314 | .0307 | .0301 | .0294 |
| -1.7 | .0446 | .0436 | .0427 | .0418 | .0409 | .0401 | .0392 | .0384 | .0375 | .0367 |
| -1.6 | .0548 | .0537 | .0526 | .0516 | .0505 | .0495 | .0485 | .0475 | .0465 | .0455 |
| -1.5 | .0668 | .0655 | .0643 | .0630 | .0618 | .0606 | .0594 | .0582 | .0571 | .0559 |
| -1.4 | .0808 | .0793 | .0778 | .0764 | .0749 | .0735 | .0721 | .0708 | .0694 | .0681 |
| -1.3 | .0968 | .0951 | .0934 | .0918 | .0901 | .0885 | .0869 | .0853 | .0838 | .0823 |

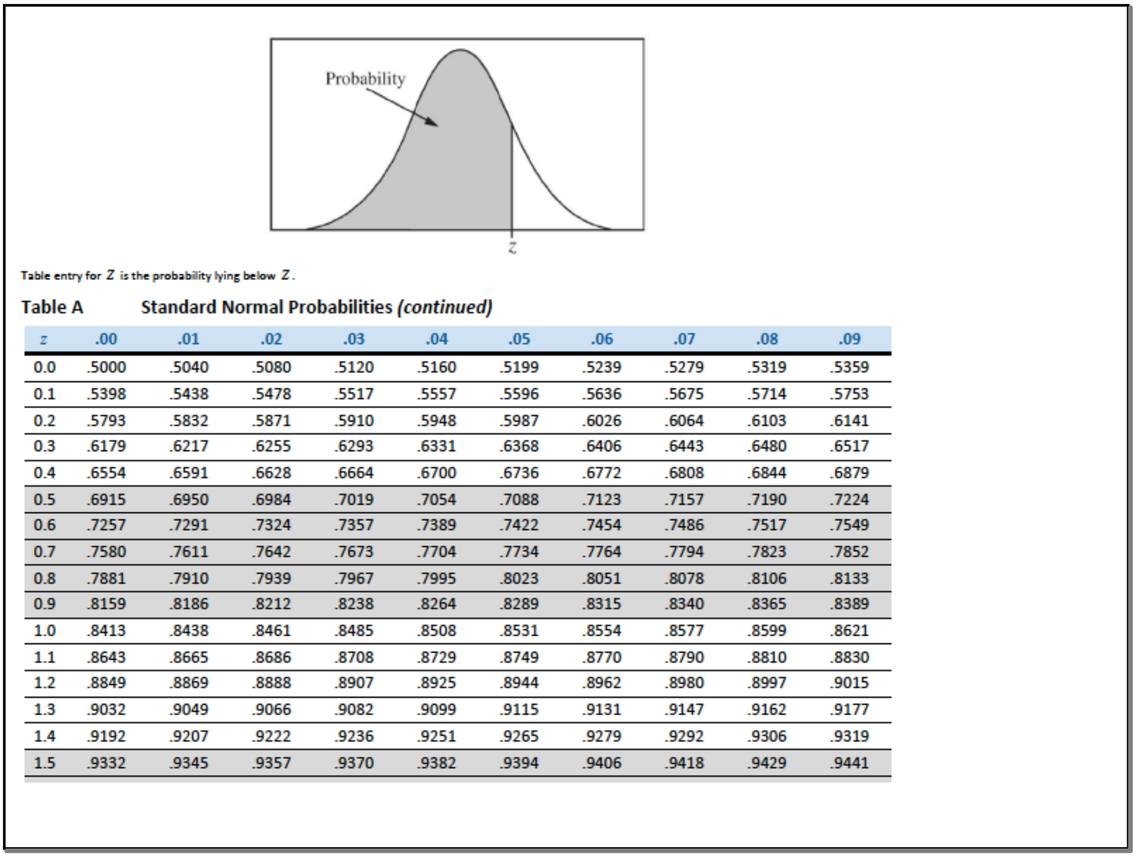
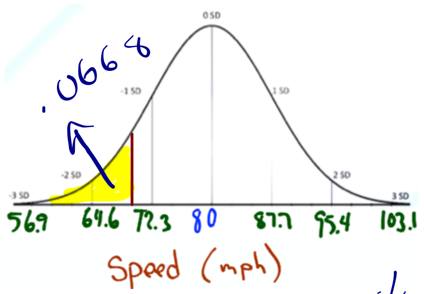


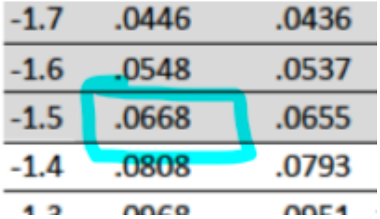
Table entry for $Z$ is the probability lying below $Z$.

**Table A** **Standard Normal Probabilities *(continued)***

| *z* | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | .5000 | .5040 | .5080 | .5120 | .5160 | .5199 | .5239 | .5279 | .5319 | .5359 |
| 0.1 | .5398 | .5438 | .5478 | .5517 | .5557 | .5596 | .5636 | .5675 | .5714 | .5753 |
| 0.2 | .5793 | .5832 | .5871 | .5910 | .5948 | .5987 | .6026 | .6064 | .6103 | .6141 |
| 0.3 | .6179 | .6217 | .6255 | .6293 | .6331 | .6368 | .6406 | .6443 | .6480 | .6517 |
| 0.4 | .6554 | .6591 | .6628 | .6664 | .6700 | .6736 | .6772 | .6808 | .6844 | .6879 |
| 0.5 | .6915 | .6950 | .6984 | .7019 | .7054 | .7088 | .7123 | .7157 | .7190 | .7224 |
| 0.6 | .7257 | .7291 | .7324 | .7357 | .7389 | .7422 | .7454 | .7486 | .7517 | .7549 |
| 0.7 | .7580 | .7611 | .7642 | .7673 | .7704 | .7734 | .7764 | .7794 | .7823 | .7852 |
| 0.8 | .7881 | .7910 | .7939 | .7967 | .7995 | .8023 | .8051 | .8078 | .8106 | .8133 |
| 0.9 | .8159 | .8186 | .8212 | .8238 | .8264 | .8289 | .8315 | .8340 | .8365 | .8389 |
| 1.0 | .8413 | .8438 | .8461 | .8485 | .8508 | .8531 | .8554 | .8577 | .8599 | .8621 |
| 1.1 | .8643 | .8665 | .8686 | .8708 | .8729 | .8749 | .8770 | .8790 | .8810 | .8830 |
| 1.2 | .8849 | .8869 | .8888 | .8907 | .8925 | .8944 | .8962 | .8980 | .8997 | .9015 |
| 1.3 | .9032 | .9049 | .9066 | .9082 | .9099 | .9115 | .9131 | .9147 | .9162 | .9177 |
| 1.4 | .9192 | .9207 | .9222 | .9236 | .9251 | .9265 | .9279 | .9292 | .9306 | .9319 |
| 1.5 | .9332 | .9345 | .9357 | .9370 | .9382 | .9394 | .9406 | .9418 | .9429 | .9441 |

5. What percentage of the runs will give the Delorean a speed less than 68.45 mph?





| | | |
|---|---|---|
| -1.7 | .0446 | .0436 |
| -1.6 | .0548 | .0537 |
| -1.5 | .0668 | .0655 |
| -1.4 | .0808 | .0793 |

~~6.68%~~

6.68%

6.7%

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# Day 2

Aim

Perform Normal Distribution Calculations

- Using Proper Terminology and process

# Day 2

Aim

Perform Normal Distribution Calculations

- Using Proper Terminology and process

Why ?

because they will help us calculate probabilities

6. What percentage of the runs will give the Delorean a speed greater than 85 mph? Show work. [Mr. Cedarlund will model how to show your work].

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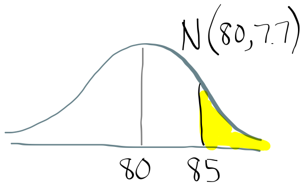
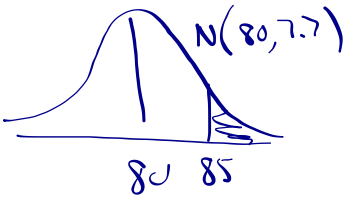


Start by drawing an un standardized normal curve



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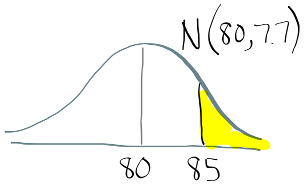
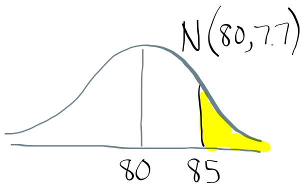
6. What percentage of the runs will give the Delorean a speed greater than 85 mph? Show work. [Mr. Cedarlund will model how to show your work].



$$Z = \frac{\text{value} - \text{mean}}{\text{SD}} =$$

calculate z-score

6. What percentage of the runs will give the Delorean a speed greater than 85 mph? Show work. [Mr. Cedarlund will model how to show your work].



$$Z = \frac{\text{value} - \text{mean}}{SD} = \frac{85-80}{7.7} = 0.65$$

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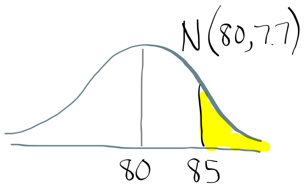
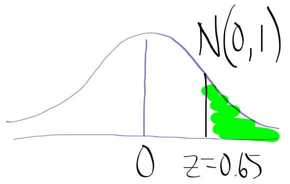
6. What percentage of the runs will give the Delorean a speed greater than 85 mph? Show work. [Mr. Cedarlund will model how to show your work].



$$Z = \frac{\text{value} - \text{mean}}{SD} = \frac{85-80}{7.7} = 0.65$$



standardized picture

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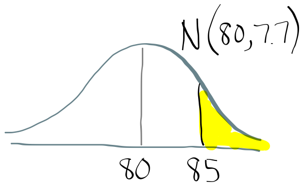

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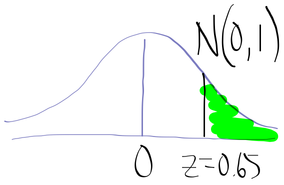

TABLE A

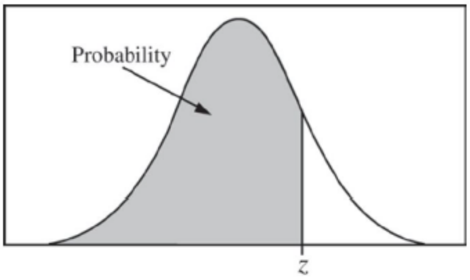

Table entry for $Z$ is the probability lying below $Z$.

**Table A** **Standard Normal Probabilities *(continued)***

| z | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | .5000 | .5040 | .5080 | .5120 | .5160 | .5199 | .5239 | .5279 | .5319 | .5359 |
| 0.1 | .5398 | .5438 | .5478 | .5517 | .5557 | .5596 | .5636 | .5675 | .5714 | .5753 |
| 0.2 | .5793 | .5832 | .5871 | .5910 | .5948 | .5987 | .6026 | .6064 | .6103 | .6141 |
| 0.3 | .6179 | .6217 | .6255 | .6293 | .6331 | .6368 | .6406 | .6443 | .6480 | .6517 |
| 0.4 | .6554 | .6591 | .6628 | .6664 | .6700 | .6736 | .6772 | .6808 | .6844 | .6879 |
| 0.5 | .6915 | .6950 | .6984 | .7019 | .7054 | .7088 | .7123 | .7157 | .7190 | .7224 |
| 0.6 | .7257 | .7291 | .7324 | .7357 | .7389 | .7422 | .7454 | .7486 | .7517 | .7549 |
| 0.7 | .7580 | .7611 | .7642 | .7673 | .7704 | .7734 | .7764 | .7794 | .7823 | .7852 |
| 0.8 | .7881 | .7910 | .7939 | .7967 | .7995 | .8023 | .8051 | .8078 | .8106 | .8133 |
| 0.9 | .8159 | .8186 | .8212 | .8238 | .8264 | .8289 | .8315 | .8340 | .8365 | .8389 |
| 1.0 | .8413 | .8438 | .8461 | .8485 | .8508 | .8531 | .8554 | .8577 | .8599 | .8621 |
| 1.1 | .8643 | .8665 | .8686 | .8708 | .8729 | .8749 | .8770 | .8790 | .8810 | .8830 |

$Z = 0.65$

Table entry for $Z$ is the probability lying below $Z$.

**Table A** **Standard Normal Probabilities *(continued)***

| $z$ | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 |
|---|---|---|---|---|---|---|---|---|
| 0.0 | .5000 | .5040 | .5080 | .5120 | .5160 | .5199 | .5239 | .5279 |
| 0.1 | .5398 | .5438 | .5478 | .5517 | .5557 | .5596 | .5636 | .5675 |
| 0.2 | .5793 | .5832 | .5871 | .5910 | .5948 | .5987 | .6026 | .6064 |
| 0.3 | .6179 | .6217 | .6255 | .6293 | .6331 | .6368 | .6406 | .6443 |
| 0.4 | .6554 | .6591 | .6628 | .6664 | .6700 | .6736 | .6772 | .6808 |
| 0.5 | .6915 | .6950 | .6984 | .7019 | .7054 | .7088 | .7123 | .7157 |
| 0.6 | .7257 | .7291 | .7324 | .7357 | .7389 | .7422 | .7454 | .7486 |
| 0.7 | .7580 | .7611 | .7642 | .7673 | .7704 | .7734 | .7764 | .7794 |
| 0.8 | .7881 | .7910 | .7939 | .7967 | .7995 | .8023 | .8051 | .8078 |

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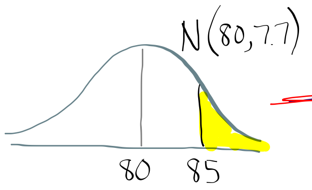
6. What percentage of the runs will give the Delorean a speed greater than 85 mph? Show work. [Mr. Cedarlund will model how to show your work].



$$Z = \frac{\text{value} - \text{mean}}{SD} = \frac{85-80}{7.7} = 0.65$$

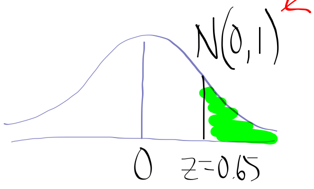
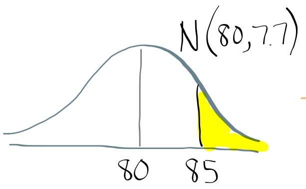


TABLE A

Area to right $= 1 - 0.7422 = 0.2478$

$\boxed{24.78\%}$

6. What percentage of the runs will give the Delorean a speed greater than 85 mph? Show work. [Mr. Cedarlund will model how to show your work].



$$Z = \frac{\text{value} - \text{mean}}{SD} = \frac{85-80}{7.7} = 0.65$$

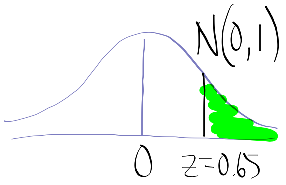


TABLE A

Area to right $= 1 - 0.7422 = 0.2478$

$\boxed{24.78\%}$

## Requirements for Showing Work (for Full Credit)
## For Normal Distribution Problems

1. Draw an "un-standardized" picture with $N(\mu, \sigma)$ and shading
2. Calculate z-score(s), showing the z-score formula and values.
3. Then draw a "standardized" picture with $N(0,1)$ and shading
4. Use Table A to find area. Then state your answer.

$$Z = \frac{\text{value} - \text{mean}}{SD}$$

## Requirements for Showing Work (for Full Credit)
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4. Use Table A to find area. Then state your answer.

$$Z = \frac{\text{value} - \text{mean}}{\text{SD}}$$

Use Table A to find <u>area</u> under any normal curve.

Use the correct side of Table A

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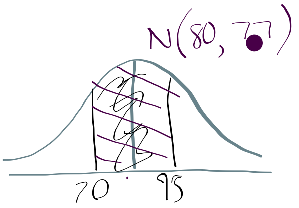
Work on questions 7 and 8

I'll be asking some of you to write your complete solution on side board.

7. What percentage of the runs will give the Delorean a speed between 70 and 95 mph? Show work.



$$Z = \frac{\text{Value} - \text{Mean}}{SD}$$

$$\frac{70-80}{7.7} = -1.3$$

$$\frac{95-80}{7.7} = 1.95$$

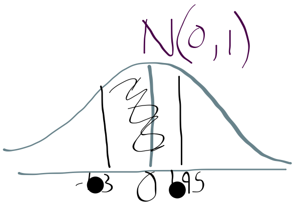


TABLE A

1.95 = 0.9744

-1.3 = 0.0968

0.9744 - 0.0968 = 0.8776

87.76%

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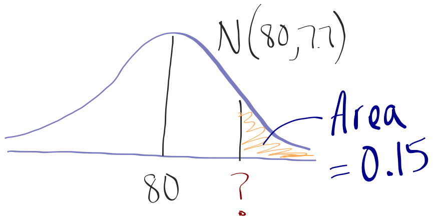
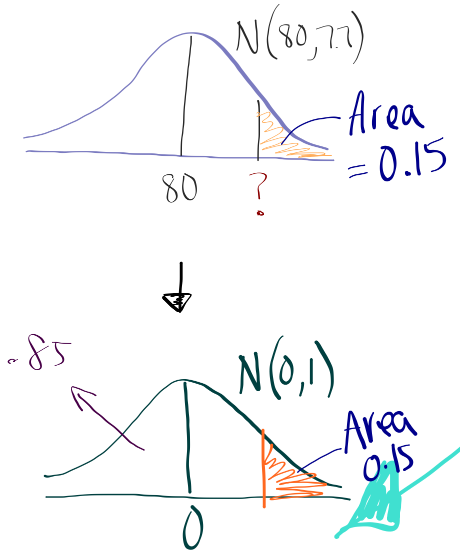
8. Marty wants his last run to be in the top 15% of all the possible speeds. What speed does he need to achieve to be in the top 15%?

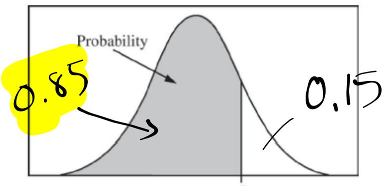


8. Marty wants his last run to be in the top 15% of all the possible speeds. What speed does he need to achieve to be in the top 15%?



Standardize and Workbackward in TABLE A To find Z-score

Area to right



Find the value closest to 0.85

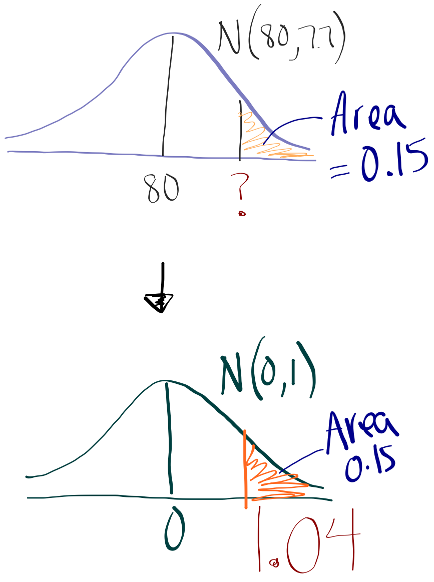
Table entry for z is the probability lying below z.

**Table A** **Standard Normal Probabilities (continued)**

| z | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .0 |
|---|---|---|---|---|---|---|---|---|---|
| 0.0 | .5000 | .5040 | .5080 | .5120 | .5160 | .5199 | .5239 | .5279 | .53 |
| 0.1 | .5398 | .5438 | .5478 | .5517 | .5557 | .5596 | .5636 | .5675 | .57 |
| 0.2 | .5793 | .5832 | .5871 | .5910 | .5948 | .5987 | .6026 | .6064 | .61 |
| 0.3 | .6179 | .6217 | .6255 | .6293 | .6331 | .6368 | .6406 | .6443 | .64 |
| 0.4 | .6554 | .6591 | .6628 | .6664 | .6700 | .6736 | .6772 | .6808 | .68 |
| 0.5 | .6915 | .6950 | .6984 | .7019 | .7054 | .7088 | .7123 | .7157 | .71 |
| 0.6 | .7257 | .7291 | .7324 | .7357 | .7389 | .7422 | .7454 | .7486 | .75 |
| 0.7 | .7580 | .7611 | .7642 | .7673 | .7704 | .7734 | .7764 | .7794 | .78 |
| 0.8 | .7881 | .7910 | .7939 | .7967 | .7995 | .8023 | .8051 | .8078 | .81 |
| 0.9 | .8159 | .8186 | .8212 | .8238 | .8264 | .8289 | .8315 | .8340 | .83 |
| 1.0 | .8413 | .8438 | .8461 | .8485 | .8508 | .8531 | .8554 | .8577 | .85 |
| 1.1 | .8643 | .8665 | .8686 | .8708 | .8729 | .8749 | .8770 | .8790 | .88 |

So 1.04

8. Marty wants his last run to be in the top 15% of all the possible speeds. What speed does he need to achieve to be in the top 15%?



---

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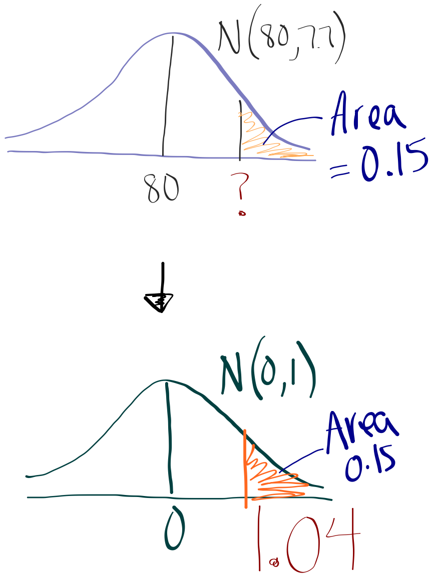
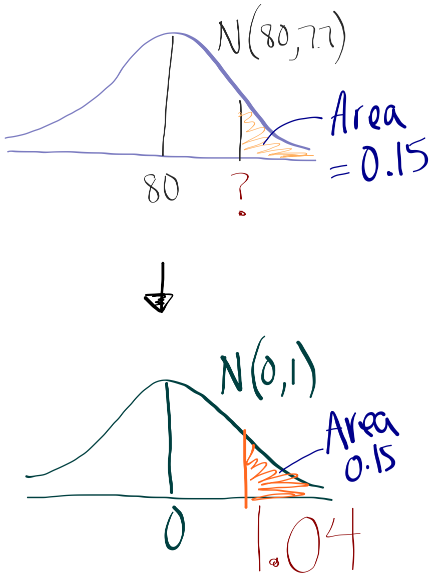


$$Z = \frac{\text{value} - \text{mean}}{SD}$$

↑

Work backwards to find the value (speed)

8. Marty wants his last run to be in the top 15% of all the possible speeds. What speed does he need to achieve to be in the top 15%?



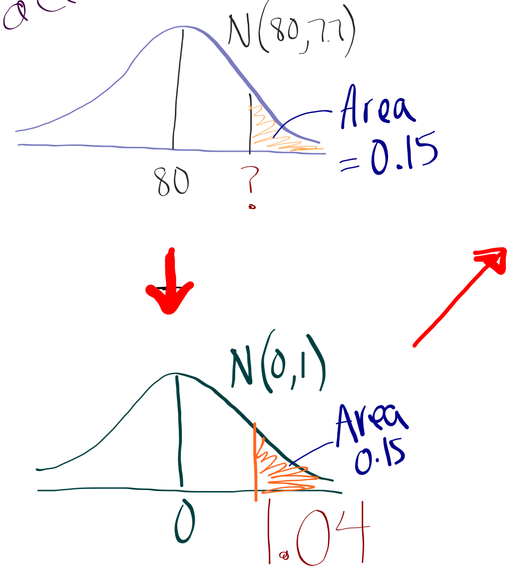
$$Z = \frac{\text{value} - \text{mean}}{SD}$$

$$1.04 = \frac{X - \overset{80}{\cancel{\text{mean}}}}{\cancel{SD}\,7.7}$$

---

8. Marty wants his last run to be in the top 15% of all the possible speeds. What speed does he need to achieve to be in the top 15%?

Backwards



$$Z = \frac{\text{value} - \text{mean}}{SD}$$

$$1.04 = \frac{X - \text{mean}}{SD}$$

SD ≈ ~~88.2~~ 88.01

so $\boxed{88.2 \text{ mph}}$

Backwards (Find a value from ~~and~~ an area)

1. Draw an "un-standardized" picture with $N(\mu, \sigma)$ and shading. Label area.
2. Draw a "standardized" picture with $N(0,1)$ and shading. Label the area.
3. Use Table A to find a z-score given your area from above.
4. Use the z-score formula to determine the value.

---

quick

B.B.

## Check Your Understanding:

When professional golfer Jordan Spieth hits his driver, the distance the ball travels can be modeled by a Normal distribution with mean 304 yards and standard deviation 8 yards.

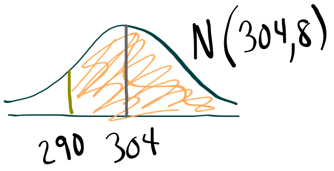
1. On a specific hole, Jordan would need to hit the ball at least 290 yards to have a clear second shot that avoids a large group of trees. What percent of Spieth's drives travel at least 290 yards?

Let's do #1
and then we'll look at
how to check answer
with calculator

## Check Your Understanding:

When professional golfer Jordan Spieth hits his driver, the distance the ball travels can be modeled by a Normal distribution with mean 304 yards and standard deviation 8 yards.

1. On a specific hole, Jordan would need to hit the ball at least 290 yards to have a clear second shot that avoids a large group of trees. What percent of Spieth's drives travel at least 290 yards?



$$Z = \frac{\text{value}-\text{mean}}{SD} = \frac{290-304}{8} = -1.75$$

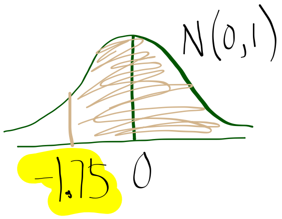
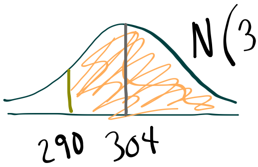


Table A
1 − 0.0400
= 0.96

$\boxed{96\%}$



$N(304,8)$

Normal cdf (290, 10000, 304, 8)

=

2. On another golf hole, Spieth has the opportunity to drive the ball onto the green if he hits the ball a distance in the top 10% of all his drives. How far does the ball have to go?

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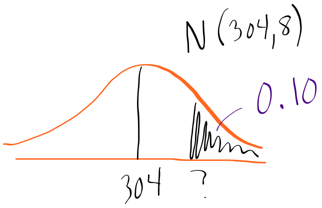

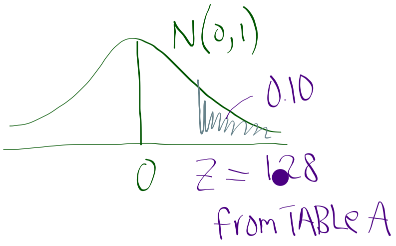

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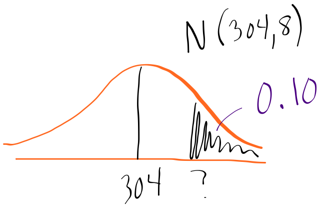
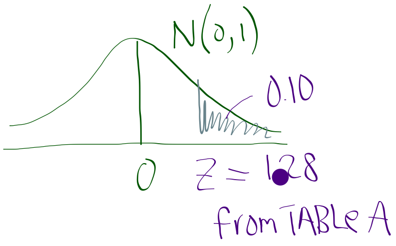




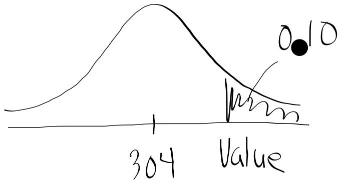
$$z = \frac{\text{Value} - \text{Mean}}{\text{SD}}$$

$$1.28 = \frac{x - 304}{8}$$

$$x = 314.24$$

$$\boxed{314.24 \text{ yards}}$$

Check w/calculator



invNorm(area to left, mean, SD)

invNorm(0.90, 304, 8)

= 314.25 yards

---

1. Draw an "un-standardized" picture with $N(\mu, \sigma)$ and shading
2. Calculate z-score(s), showing the z-score formula and values.
3. Then draw a "standardized" picture with $N(0,1)$ and shading
4. Use Table A to find area. Then state your answer.

**Calculator instructions for Checking Answers**

Find Area: normalcdf(left, right, mean, SD)

Backwards to find value: invnorm(area to left, mean, SD)

Assignment

**2.2** ....53, 55, 57, 59, 61,63

and study pp. 119-131